AS Music Technology - Close-Mic Techniques

By the end of the AS level course you need to have studied and have some experience of recording the instruments listed below. An understanding of the common methods of microphone choice and placement, together with the problems or difficulties you may encounter with each instrument, is tested in two ways:

1. Recording Coursework (Task 1 - Close-Mic Recording)

   In order to produce a high quality recording the appropriate choice and positioning of microphones is a key factor, and will be marked accordingly.

2. Listening & Analysing Exam

   You could be asked to demonstrate your knowledge of close-mic techniques in relation to any of the commercial recordings featured in the exam.

What is 'close miking'? -

Close miking explained:	'Close miking' is a term associated with studio recording, where all instruments are recorded (on separate tracks) with microphones that are positioned close to instruments so as to capture the 'direct' sound and tonal characteristics of the instrument. This gives the engineer maximum control when it comes to 'blending' the sounds at the later mixdown stage. As a general rule very little 'room ambience' is captured when close-mic'ing, although some recording studios do have specially designed acoustic areas (e.g. 'stone rooms', 'live rooms') whose properties are deliberately captured during the recording process. Most commercial recordings feature a predominant use of close-mic techniques.

Choosing A Microphone -

Which microphone?	For many instruments using a dynamic or condenser microphone will yield equally successful results. The microphone types suggested below for different instruments are a good starting point and based on 'received wisdom'. An understanding of the fundamental differences between microphone types and the characteristics they exhibit is essential if the suggestions below are to make sense and to be understood fully. Make sure you visit the Mic Types pages in conjunction with the various methods described below.

Polar Patterns - back to top

Which pattern?: In the majority of close miking situations a cardioid pattern is the first choice of polar pattern: a cardioid pattern is wide enough to capture enough of the full bodied sound of most instruments and will help prevent too much room ambience from being captured. However, if recording in a good sounding room or ambient space (one that will enhance the quality of the recording, or that will sound good in a final mix), or when recording a complex sounding instrument that requires more 'space' for the its natural sound to come across, an omni-directional microphone might yield better results. As always, the suggested methods described below should only be a starting point for further investigation.

Mic Distance -

How far away? Despite the guidelines offered below, it is not possible to set exact miking distances for an instrument. Most instruments require a little space for the full body of their sound to come across, so miking too close will not always capture an accurate 'composite' sound. Conversely, miking too far away can pick up non-direct, ambient sounds, some of which may be undesirable. As explained below, there are some situations where miking very close to an instrument is a necessary 'evil' and there are other situations where miking a little further away (if the ambient sound of the room is nice and useable) is similarly practical. Just remember that dynamic microphones are only suitable for miking at close distances of a few inches, so more distant miking is not an option as far as they are concerned.

Tonal Balance: Miking too clse can colour the recorded tone quality of an instruments. If you mike too close you might hear a bassy or honky tone instead of a natural sound. This is because instruments are designed to sound best at a distance, at

least 1 to 2 feet away. The sound of an instrument needs space to develop. A microphone placed a foot or two away tesnds to pick up a well-balanced, natural tone. Once again, this is a general guide rather than a rule, and each instrument must be considered separately, according to its characteristics not to mention the acoustic characteristics of the recording venue.

On or Off-Axis? -

Additional tone control:

Remember that positioning a microphone on or off-axis to a sound source gives additional control over the tone of a recording. Note the following example. A microphone with a cardioid polar pattern delivers optimum frequency response and sensitivty to sounds arriving at 0 degrees to the capsule. However, a sound arriving at 20 degrees might be slightly coloured as most cardioid microphones are less sensitive at this angle, and don't exhibit such an accurate high frequency response. This colouration can be an advantage when trying to balance certain (loud, harsh, bright, etc.) sounds.

The 3 to 1 Rule -

Using multiple mics:

The 3 to 1 rule states that a second microphone (intended for a different instrument) must be positioned three times further away than the microphone is from the sound source. For example, if a microphone is 8 inches away from one of two singers, then the microphone for the second singer must be at least 24 inches away from the first microphone.

This accepted rule is necessary if unpleasant side effects (particularly 'phase cancellation') caused by spill

are to be avoided.

ACOUSTIC GUITAR -

Microphone Type: CONDENSER

Acoustic guitars have a very wide dynamic range and frequency range, encompassing almost the entire audio spectrum. They produce very rich and complex tone colours with lots of high frequency detail.

OMNI-DIRECTIONAL

*In conjunction with a **good sounding room** an omni-directional microphone works very well when recording acoustic guitar as it responds better to the combination of the full body resonances of the guitar together with the ambience of the room.*

Microphone Placement:

Method 1 - Behind The Bridge

Position the microphone to the left of the guitarists 'strumming' hand just beyond the bridge.

Expected Sound: Bright, tight and metallic sound, with emphasised mids.

Method 2 - Over The Neck

Position the microphone at the front of the neck between the sound hole and where the neck

joins the body of the guitar.

Expected Sound: Full sound with a good balance of bridge, sound hole and neck tones.

Method 3 - Over The Sound Hole

Position the microphone directly over the sound hole.

Expected Sound: Strong sound - high signal level - tone full of body resonances, dull and boomy.

Method 4 - Close Mic'ing The Fretboard

Position the microphone further up the fretboard, away from the neck.

Expected Sound: Thin, percussive sound, with emphasised string noise.

Method 5 - DI Box

not a close-mic technique, but can be used in conjunction with a close-mic, with the final result being achieved by blending together the dry sound of the DI feed with the sound of the microphone.

Expected Sound: Using a DI box on its own will produce a very dry, almost unnatural sound, which will need to be blended with a mic signal, or processed with a good effects processor to generate a richer tone.

Other Factors/Problems:

- Finger noise/string noise
- Breathing noise (from the guitarist)
- Deciding whether to record stereo or mono
- 'Boomy' , 'dull' sound (when too near sound hole)
- Capturing 'full' sound of the instrument
- Capturing room ambience

BASS GUITAR -

Microphone Type: DYNAMIC

There is not much high frequency detail in a bass guitar's sound that is worth picking up with a condenser microphone. Also, bass guitar amps can produce very high level outputs, so the high sensitivity of condenser microphones might present a problem.

Microphone Placement:

Method 1 - Amp'd Bass

Microphone positioned at the centre of the speaker

Expected Sound: Bright sound with lots of attack

Method 2 - Amp'd Bass

Microphone positioned at the edge of the speaker

Expected Sound: A warmer tone

Method 3 - Amp'd Bass + Ambient Mic

A second ambient microphone (would need to be a

condenser microphone) positioned a metre or so away, in combination with either of the 2 methods (or both if there are enough mics), the 2 (or 3) sources are then blended either live or at the mixdown stage.

Expected Sound: The close-mic'd sound of the amp together with a live, ambient sound.

Method 4 - DI Box

A DI box can be used to take a direct signal from the Bass Guitar directly into the mixing desk.

Expected Sound: The DI sound in its own sounds very dry and 'clinical', although can work well for Bass Guitar more than Electric Guitar. The best results are probably acheived however by using a DI'd signal in combination with either method 1 or 2 above. Alternativley, Amp Modelling software or hardware can be used to process the sound of the DI'd Bass, recreating the effect of a Bass Amp.

Other Factors/Problems:

- Can sound muddy/unnatural
- Fret noise/string buzzing
- Amplifier hiss/buzz/feedback
- Signal level can be very strong
- 'Boominess' - sometimes needs careful EQ

CHOIR/VOCAL GROUP -

NOTE: General rules, guidelines and troubleshooting issues about vocal recording still apply when recording vocal groups. See the recording vocals section of this page for more information.

Microphone Type:

CONDENSER or DYNAMIC

See methods below for examples of where to use each type.

Microphone Placement:

<u>Method 1 - Separate Mics</u> (Condenser or Dynamic Microphones)

For small groups (about 3 or 4) each singer could use a separate microphone, ideally on separate tracks. Singers must be separated by acoustic screens or the 3 to 1 rule must be observed.

Expected Sound: Direct, dry sound that can be mixed to provide sense of stereo space and blend.

<u>Method 2 - Stereo Recording</u> (Condenser Microphones)

For small groups (about 3 or 4) an illusion of space can be created by setting up a stereo coincident pair of mics in the room and then moving the performers for each new recording/take. E.g. 3 (simultaneous) tracks could be recorded with the singers positioned left, then centre, and then right of the mics. For more information about stereo microphone techniques visit the Ambient Recording pages.

Expected Sound: 'Illusion' of three groups of people exisiting at the same time in a real stereo soundspace

<u>Method 3 - Omni-directional Microphone/Bi-directional Microphone</u>

If recording 2 singers, an omnidirectional microphone or bi-directional (better for separating the sound of each singer) or polar pattern can be used. But bear in mind that both voices will be recorded onto the same track, and cannot be separated later for the purposes of mixing.

Other factors/Problems:

- Adequate monitoring - performers must be able to hear each other
- Headphone spill
- Different stand positions/mic positions to suit each voice
- See the recording vocals section of this page for more issues.

Reading:

Recording & Production Techniqes page 37

Basic Microphones pages 105-106

CLARINET -

Microphone Type: CONDENSER

The clarinet produces a rich, complex sound, full of overtones. It is also capable of generating both very soft and very loud dynamics. Only a condenser microphone can adequately capture the full frequency range of frequencies and is sensitve enough to capture its full dynamic range.

Microphone

NOTE: Contrary to what you might think, the sound

Placement:

of a woodwind instrument does not radiate from the 'bell' or mouthpiece. The sound actually emanates from the finger holes or sound holes that span the instruments entire length.

Method 1 - Above The Sound Holes

A cardioid condenser microphone about 12 inches from the sound holes but coming from above so that it is pointing towards the lowest key. Positioning the microphone a little to one side of the instrument will help to minimise key noise.

Expected Sound: A well balanced sound capturing the full body of the instrument with not too much key noise.

Method 2 - Close To The Sound Holes

A cardioid condenser microphone 6 to 12 inches on-axis to the sound holes (or slightly off-axis to minimise key noise)

Expected Sound: In the low register this position can sound very warm and breathy, suitable for quiet expressive solos but not so suitable for performances using a wide range of pitches and dynamics.

Method 3 - Live Recording

In a live recording situation the performer might well move around and can't be expected to stay 'in situ', therefire a clip-on microphone might be more suitable (again, positioned over the keyholes, capturing the body of the instrument).

Other

- Key noise

Factors/Problems: - Breath Noise
- Reflections from the floor (particularly at higher frequencies)
- High sound pressure at high frequencies and when playing loud.

DRUM KIT -

NOTE: Theories of mic'ing drum kits are very varied and often very complex. So the process of trying to arrive at a basic overview is almost impossible. It is often the hardest 'instrument' to record, not least because 'what makes a good drum sound' has much to do with the style of the music, the make of the kit, and the standard of the player. Arriving at the 'right' recording technique will, in part, be determined by these considerations. However, below are some 'failsafe', 'tried and tested' and recognised drum mic'ing techniques that should produce satisfactory results. **All of these methods will be wasted though if you fail to follow these simple but crucial rules - before you've unpacked a single microphone:**

1. *Tune The Kit - If you don't know how, ask a drummer*

2. *Allow Enough Time - It takes time, care and thought to set up*

3. *Observe The Player - Spend time studying and listening to the player*

Microphone Type:

A combination of CONDENSER and DYNAMIC types

See below for where different types are used

Microphone Placement:

The methods outlined below use a combination of close-mic'ing and ambient mic'ing techniques. Note that with all these methods, the exact positioning of the microphone (i.e. how far from the drum concerned, angled to what part of the drum head) can sometimes only be determined by careful listening and trial and error. For more detailed ideas and explanations, refer to the **essential reading** *material below. As far as the AS Close-MIc Recording coursework is concerned, 'less is more', i.e. a very high mark can be used with a 3 or 4 microphone technique.*

Method 1 - One Mic In Front

One cardioid condenser microphone positioned in front of the kit, apporximately 6 feet above the floor.

Expected Sound: A mono recording, i.e. no stereo image (this will reduce the 'natural' sound of the kit, but some room ambience depending on the acoustics of the space.

Method 2 - One Mic Overhead

One cardioid condenser microphone pointed down at the drums from a distance of about 4 feet.

Expected Sound: Similar to above, but with cymbals more prominent in the resulting

recording.

Method 3 - One Mic 8 Feet Away

A single cardioid or omni-directional condenser microphone positioned 8 feet from and pointing towards the kit.

Expected Sound: Given a good sounding room, this will pick up much more room ambience and create a 'liver' sounding recording.

Method 4 - One Mic Overhead, One On The Kick

One cardioid condenser microphone pointing down at the kit and one cardioid dynamic microphone inside the kick drum, aimed at the head, about halfway between the centre of the head and the shell

Expected Sound: Similar to Method 2 but with added focus to the kick.

Method 5 - Coincident Pair/Stereo X-Y Pair

Two cardioid condenser microphones about 3 feet above the cymbals. The microphones are in coincident pair or X-Y configuration (see the Ambient Recording pages) pointing down at the drums (placement and distance above the kit dependent on what achieves the best musical balance).

Expected Sound: A very natural drum sound, but perhaps not suitable for a very 'commercial' drum sound.

Method 6 - Three Microphones

One cardioid condenser microphone 2 feet above the cymbals, pointing down at the kit; One cardioid dynamic microphone pointing at the top of the snare (positioned for the best sound); One cardioid dynamic microphone inside the kick (positioned for the best sound).

Expected Sound: A less natural sound but more 'commercially' viable. This configuration only provides a mono representation of the kit, and no stereo image.

Method 7 - Coincident Pair & Kick

Two cardioid condenser microphones in a coincident pair or X-Y configuration above the kit (placement and distance above the kit dependent on what acheives the best musical balance); One cardioid dynamic microphone inside the kick (positioned for the best sound)

Expected Sound: Stereo image of the kit with added kick drum focus mixed in, although individual control of the snare is sacrificed.

Method 8 - Coincident Pair, Kick & Snare

Two cardioid condednser microphones in a coincident pair or X-Y configuration above the kit (placement and distance above the kit dependent on what achieves the best musical balance); One cardioid dynamic microphone inside the kit (positioned for the best sound); One cardioid dynamic microphone pointing at the top of the snare (positioned for the best sound).

Expected Sound: Stereo image of the whole kit, with added focus and 'solidity' to the kick and snare. Note that careful positioning of the snare in the stereo field may need consideration in order to make it 'sit' with the stereo image of the kit provided by the stereo pair.

Method 9 - Full Close Mic'ing

The most common 'commercial' drum mic'ing technique is to close-mic all (or nearly all) the drums. For example: two cardioid condenser microphones in a coincident pair configuration (experiment with placement and distance above the kit to find the appropriate musical sound); one cardioid dynamic microphone inside the kick (positioned for the best sound); one cardioid dynamic microphone pointing at the top of the snare (positioned for the best sound); one cardioid dynamic microphone pointed at the floor tom (positioned for the best sound); one cardioid dynamic microphone aimed between the upper two toms, so that the two drums are balanced and blended.

Expected Sound: A 'commercial' detailed sound, with upfront snare, toms and kick, blended with an overall stereo image of the whole kit. Note that very careful mixing of all the sources is required for this technique to work effectively.

More On Positioning:

As mentioned above, the exact position of each microphone is as much an art as it is a science - experimentation and common sense is required. To demonstrate just how crucial positioning is (even by small amounts) in shaping and capturing the sound, here are some examples of microphone placement relating to the kick drum:

Other Factors/Problems:

- Spill from other drums (when close-mic'ing)
- High signal levels/pressure levels
- Rattles/noises
- Tuning the kit
- Cymbals hitting the mics
- Air noise from hi-hat

ELECTRIC GUITAR -

Note:

Where the electric guitar is concerned, mic'ing the instrument itself is not pracitcal, or of much use. The ***amplifier*** must be the prime focus of any mic'ing techniques: the guitar amp can be regarded as the 'instrument'.

Microphone Type:

DYNAMIC or CONDENSER

Dynamic microphones are particularly well suited to mic'ing guitar amps as they can handle high sound pressure levels, and often exhibit a 'presence peak' that compliments the typical electric guitar sound, giving it a more agressive 'bite'. Condenser microphones can deliver a cleaner, brighter sound, more like the 'classic' guitar sounds of previous eras, but they are more sensitive to sound pressure levels (though note that better results are often achieved when recording electric guitars by setting the amp to a slightly ***lower level*** *than when in performance). There seems to be a preference amongst American engineers for using condenser microphones, whilst their British counterparts often opt for the traditional dynamic microphone.*

Microphone Placement:

<u>Method 1</u>

A single cardioid microphone (dynamic or condenser) positioned (approx. 6 inches) from the centre of the speaker cone.

Expected Sound: A sound with more high frequency edge

Method 2

A single cardioid microphone (dynamic or condenser) positioned (approx. 6 inches) from the speaker cone, but towards its outer edge.

Expected Sound: A warmer, smoother sound with less treble (high frequencies)

Method 3

A combination of Method 1 and Method 2 (above) - using any combination of dynamic or condenser microphones.

Expected Sound: By adjusting the relative levels between the two microphones, either live (i.e. direct to a single mono track) or at the mixdown stage (i.e. keeping each micropone source on a separate track) a blend can be achieved between the edgier, high frequency prominence of method 1 and the warmer, smoother sound of method 2.

Method 4

One or two cardioid microphones (dynamic or condenser) according to methods 1 to 3 (above), together with omni-directional condenser microphone at least several feet away from the amp.

Expected Sound: The omni-directional microphone acts as an ambient mic, and in a good sounding room, will pick up both the sound of the amp and the acoustic of the room creating a 'liver' sound. As in method 3, the different sources can be

blended together to achieve a desired mix between ambient and direct sounds.

Method 5

In addition to methods 1 - 3 (above) and additional cardioid microphone (dynamic or condenser) can be positioned behind the guitar amp - **this method is only applicable when using an open backed amp**.

Expected Sound: Mic'ing the rear of an open backed cabinet can add extra definition to the sound, particularly in the lower mid frequencies.

Method 6

Direct Injection (DI Box). Sending an electric guitar output through a DI box and straight into the mixing desk will, in itself, not usually give very satisfactory results. This technique essentially bypasses the amp, one of the fundamental parts to the overall sound. However, if the DI'd sginal is passed through a guitar amp modeller (either in hardware or software form - see the *Music Tech Magazine* article, below) then good results can be achieved. Guitar amp modelling has the added advantage of eliminating guitar amp noise and distortion (as it is a virtual, digital effect).

Extra Factors/Issues:

- Buzzing strings
- Amp noise/buzz/hum
- High signal levels
- Feedback
- Pick-up interference

FLUTE -

Microphone Type:

CONDENSER

The flute can be both mellow and shrill in sound and it's highest 'fundamental' note is much higher than the clarinet. The 'breathy' part of the flute's sound is an important feature of its timbre, and is made up of very high frequencies. Only a condenser microphone can adequately capture the full frequency range of frequencies and is sensitve enough to capture its full dynamic range.

Microphone Placement:

NOTE: Contrary to what you might think, the sound of a woodwind instrument does not radiate from the 'bell' or mouthpiece. The sound actually emanates from the finger holes or sound holes that span the instruments entire length.

Method 1

A single cardioid condenser microphone placed slightly above the player and between the mouthpiece and the instrument's footpiece, at a distance of 6 inches up to a few feet.

Expected sound: A natural and balanced sound, with not too much breath noise.

Method 2

A single cardioid condenser microphone placed slightly above the player and positioned in front of the mouthpiece, at a distance of 6 inches up to a few feet.

Expected Sound: A breathy, intimate sound, suitable

for solos but susceptible to wind noise (a wind shield may be needed)

GRAND PIANO -

Microphone Type:

CONDENSER (or OMNI-DIRECTIONAL in some situations)

The piano has one of the widest ranges (or 'tessituras') of all instruments, from 27Hz to about 4100Hz. When struck with the key hammer, each string does not simply sound in isolation but causes many others to vibrate in sympathy (particularly when the sustain pedal is depressed). The resulting sound is acoustically very complex, rich in overtones. On a grand piano, this sound is further enriched by the wooden soundboard, casework, and longer strings. Only a condenser microphone (or microphones) can accurately capture the sound of a grand piano.

Microphone Placement:

Before looking at a number of methods for close mic'ing grand pianos, several points to note:

- *When using two microphones, if they are positioned too close to the strings it is hard to achieve a good blend or transition between the 'highs' and 'lows': too close and the middle range notes aren't captured*
- *Consider the playing style and range of notes of the particular piano piece or track being recorded. Many pop songs use a very limited range of notes on the piano (mostly the middle octaves) so this might influence descisions about placement.*

Method 1 - One Microphone From Three Feet

With the piano lid fully open, one cardioid condenser (or omni-directional) microphone positioned from about 3 feet (this will be more or less level with the opening of the lid). Exact position relative to the front or back of the piano will be determined by the characteristics of the piano, and the sound desired.

Expected Sound: a mono sound, thus no stereo spread, less full bodied than method 1, but an accurate image and possibly easier to mix (Note: using an omni-directional microphone will capture a fuller sound).

Method 2 - One Microphone From Six Feet

With the piano lid fully open, one cardioid condenser (or omni-directional) microphone positioned from about 6 feet.

Expected Sound: Similar to method 2 (above) but with added room ambience. (Note: using an omni-directional microphone will capture a fuller sound and potentially more room ambience).

Method 3 - Two Condenser Microphones By The Hammers

Two cardioid condenser microphones a few inches behind the hammers: one aimed towards the high treble strings and one aimed towards the low bass strings. Each microphone about 8 inches from the strings and one foot apart.

Expected Sound: with each microphone panned left and right across the stereo spectrum a tight stereo image is achieved, with treble and bass notes perceived to be quite close in relation to each other. With each microphone quite close to the hammers the attack portion of the sound is quite prominent.

Method 4 - Two Condenser Microphones By The Hammers (Further Apart)

The same configuration as in method 3 (above), but with each microphone further apart.

Expected Sound: A different, potentially more controlled blend, between the treble and bass notes.

Method 5 - Stereo Grand Piano

Two cardioid condenser microphones, one positioned over the high treble strings 6 - 8 inches from the strings themselves and 6 - 18 inches behind the hammers. The second microphone is positioned over the lower bass strings 6 - 8 inches from the strings themselves and 2 - 4 feet from the *end* of the piano. At the mixdown stage, the two sources are panned left and right across the stereo spectrum.

Expected Sound: A big, rich, full bodied sound, suitable for instrumental solos and vocal support, but not so good for a 'busy' or pop mix.

Other Factors/Issues:

- Capturing the full range of the piano
- Piano lid full or half-open?
- Key noise/hammer noise
- Damper noise (particularly from sustain pedal)
- Style of piano playing

SAXOPHONE

Microphone Type:

DYNAMIC (or CONDENSER in some situations)

Like the electric guitar, the sax has sound characteristics similar to the human voice. And that's why the shaped response of a dynamic microphone is generally preferred.

Microphone Placement:

NOTE: Contrary to what you might think, the sound of a woodwind instrument does not radiate from the 'bell' or mouthpiece. The sound actually emanates from the finger holes or sound holes that span the instruments entire length.

Method 1 - Mic'ing the Bell

A cardioid dynamic microphone close to the rim of the bell at a distance of 6 - 12 inches. The microphone can be aimed directly into the bell, but distance from the instrument needs to be greater, at least 12 inches, to pick up the body of the sound.

Expected Sound: A very bright, forceful sound, suitable more for rick solos. Less risk of finger/key noises

Method 1 - Close To The Sound Holes

A cardioid microphone positioned from about 12 inches on-axis (or slightly off-axis to help reduce key noise) to the sound holes.

Expected Sound: A full-bodied warm and intimate sound, good for quiet solos. Key noise is likely to be captured though.

Method 2 - Above The Sound Holes

A cardioid microphone positioned above the bell roughly at the middle of the instrument, aimed slightly downwards towards the bell from about 12 inches away.

Expected Sound: A natural and well balanced sound and a 'fail-safe' position

Method 3 - Clip-on Microphone

A minature clip-on condenser microphone secured to the rim of the bell, aimed directly into the bell. This would be more practical in a live recording environment.

Expected Sound: Very bright, punchy, aggressive sound, with maximum isolation from finger/key noise, and not much of the 'body' of the instrument in the sound.

Other Issues/Factors:

- Finger noise
- Key noise
- Type of saxophone, i.e. soprano, alto, tenor, baritone (soprano sax has no bell)

SAX/BRASS ENSEMBLE -

Microphone Type:

Combination of DYNAMIC and CONDENSER microphones

Given that there are so many potential combinations of brass and sax instruments it would not be possible to list a microphone technique for every one. As ever, careful thought and common sense, informed by some basic rules, can lead to a few standard methods.

Microphone Placement:

Method 1 - Stereo Pair (3-4 instruments)

Two cardioid condenser microphones at a couple of metres distance and about 2 metres in height (i.e. in a spaced pair configuration). Appropriate balance between instruments is achieved by moving certain players closer to or further away from the microphones (e.g. in a small ensemble of 2 trumpets and a saxophone, the saxophone might need to be be brought forward to balance with the louder trumpets)

Expected Sound: A balanced sound between all instruments positioned across the stereo field (if panned appropriately) with some room ambience.

Method 2 - One Microphone Per Two Instruments

For two instruments of the same family, one cardioid condenser (for saxophones) or dynamic (for trumpets) microphone can be used per two players. Positioning should be the same as above, about 2 metres infront and at about 2 metres height. Balance between instruments would be controlled by

the performers themselves.

Expected Sound: A mono recording with a blend between instruments and some room ambience.

Method 3 - 5 Or More Players

3 or 4 microphones at a height of about 2 metres and about 2 metres in front. Make sure that the 3-to-1 rule is adhered to. If there are any solos, individual spot microphones (using the saxophone close-mic techniques, see above) can be used. When recording a larger section the additional challenges are ensuring that the individual payers can communicate visually, hear each other, and keeping the louder horns (trumpets) from smothering the quieter horns (saxophones, trombones) in their individual microphones.

Other Factors/issues:

- Communication between players (visual and aural)
- Spill between microphones
- Balancing volume levels between instruments

STRING ENSEMBLE -

Microphone Type: CONDENSER

The high sensitivity of condenser microphones allows them to be positioned further away from individual string instruments or parts of the ensemble than dynamic microphones. Also, their wide frequency response, combined with tonal accuracy, suit the complex sound character of string sections very well.

Microphone Placement:

Note: mic'ing string ensembles is most likely to involve a combination of close-mic and ambient and stereo mic techniques. String ensembles and groups benefit particularly from playing and being recorded in rooms or studios with good ambient characteristics: their combined sound needs space in which to blend and 'bloom'. Visit the Ambient Recording pages for more information about ambient and stereo microphone techniques.

String Quartet - Method 1

A stereo coincident or X-Y pair positioned about 7 feet high and 4 feet away from the line between cello and first violin.

Expected Sound: Stereo image of the 4 instruments with some room ambience

String Quartet - Method 2

A single cardioid condenser microphone positioned about 3 feet in front of each

instrument (refer to violin/viola, cello and double bass close-mic techniqes for more precise positioning relative to each instrument). The stereo position of each close-mic can be adjusted at the mix down stage to re-create the physical spacing of the instruments. An additional stereo coincident or X-Y pair can also be positioned about 7 feet high and 4 feet away from the line between cello and first violin, performing the equivalent role of drum kit 'overheads'.

Expected Sound: Direct and 'up-front' capture of each instrument with added stereo imaging and some room ambience provided by the stereo pair (if used)

String Ensemble

For 'chamber strings' set up (in the region of 12 violins, 4 violas, 4 cellos, and 3 double basses) use 1 cardioid condenser microphone to the front (about 2 to 3 feet) and slightly above each group of 4 violins or violas. For smaller ensembles use 1cardioid condenser microphone positioned about 1 to 2 metres in front and slightly above and between each pair of violins or violas. As a general rule, whatever the size of the ensemble, it is best to use one cardioid condenser microphone positioned between each cello or double bass. An additional stereo coincident or X-Y pair can also be positioned about 7 feet high and starting about 4 feet behind the conductor (or the place where you would expect to see a conductor)

TRUMPET -

Microphone DYNAMIC or (CONDENSER microphone, but see

Type: below for qualification)

Within in a metre of most brass instruments, the sound pressure levels are so high that condenser microphones (which are far more sensitive than dynamic microphones) might well be unable to cope. Although a condenser microphone will capture a more accurate sound, it is best to use a model that has an 'attenuation pad' switch that can reduce the sensitivity of the microphone by up to -20dB.

Microphone Placement:

Method 1 - 2 Metres

A single cardioid dynamic (or condenser, but see the comment above) microphone about 2 metres from the bell and 30 degrees off-axis from the bell, coming from slightly above.

Expected Sound: A natural and full sound which can also sound dramatic. Moving the microphone on-axis to the bell will produce a brighter tone.

Method 2 - Close Position

A single cardioid dynamic microphone (a condenser microphone in this situation would **not be suitable**) about 1 to 2 feet from the bell, but off-axis.

Expected Sound: The closer to the bell, the tighter and punchier the sound, suitable really only for up-front rock and funk etc. Care must be taken though, as moving the microphone too close and all the tone and body of the instrument can be lost. Key noise and valve noise can be a problem at this close position.

Other Factors/Issues:

- High sound pressure levels
- Wind noise
- Some key noise
- Water noise

TROMBONE - back to top

Microphone Type:

DYNAMIC or (CONDENSER microphone, but see below for qualification)

Within in a metre of most brass instruments, the sound pressure levels are so high that condenser microphones (which are far more sensitive than dynamic microphones) might well be unable to cope. Although a condenser microphone will capture a more accurate sound, it is best to use a model that has an 'attenuation pad' switch that can reduce the sensitivity of the microphone by up to -20dB.

Microphone Placement:

Method 1 - 2 Metres

A single cardioid dynamic (or condenser, but see the comment above) microphone about 2 metres from the bell and 30 degrees off-axis from the bell, coming from slightly below..

Expected Sound: A natural sound. This cposition can produce a mellower sound suitable for jazz. Moving the microphone on-axis to the bell will produce a

brighter tone.

Method 2 - Close Position

A single cardioid dynamic microphone (a condenser microphone in this situation would **not be suitable**) about 1 to 2 feet from the bell, but off-axis.

Expected Sound: The closer to the bell, the tighter and punchier the sound, suitable really only for up-front rock and funk etc. Care must be taken though, as moving the microphone too close and all the tone and body of the instrument can be lost.

Other Factors/Issues:

- High sound pressure levels
- Wind noise
- Some key noise
- Water noise

UPRIGHT PIANO - back to top

Microphone Placement:

Method 1 - Stereo Mic'ing

A stereo pair coincident or X-Y pair, or a spaced pair of cardioid microphones (or omni-directional is using a spaced pair) positioned just inside the top of the piano with the lid open. If using a spaced pair, the the tonal balance between high and low notes can be adjusted by moving each microphone.

Expected Sound: A stereo image blending the high and low notes with some degree of warmth.

Method 2 - Close Mic'ing

Note: accessing the strings of an upright piano is much harder than on a grand piano. The front of the piano or the kick board (below the keyboard) first needs to be removed.

Two cardioid or omni-directions condenser microphones, one positioned about 12 inches over the treble strings and the other about 12 inches over the bass strings. With the front boards of the piano removed, either the section of strings above the keyboard or below the keyboard can be miked.

Expected Sound: Full tonal range of the piano, with a percussive attack and less ambience and body to the sound. Some hammer noise might be present.

Method 3 - Close Miking The Rear

Note: the sondboard of the piano must be facing into the room, not next to a wall, for this method to be effective.

The same relative positioning as method 2 (above) but miking the soundboard at the rear of the piano (note that the soundboard of some pianos have a piece of material mounted on a wooden frame, and this would ideally need to be removed)

Expected Sound: Less percussive attack and hammer noise than method 2 (above).

Method 4 - PZM Microphones

Secure or tape one or two PZM microphones to the wall directly behind the soundboard of the piano. If using two PZM microphones they can be positioned parallel to the horizontal position of the treble and bass strings

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Other Factors/Issues:

- Positioning the piano in the room

- Removing the front (or rear) panels

- Less rich tone in the bass registers

VIOLIN/VIOLA -

Microphone Type:

CONDENSER

The high sensitivity of condenser microphones allows them to be positioned further away from individual string instruments than dynamic microphones. Also, their wide frequency response, combined with tonal accuracy, suit the complex sound character of string instruments very well.

Microphone Placement:

Because of the complex acoustical characteristics of string instruments, the sound radiates from the body of a string instrument in different directions depending on the fundamental frequency and playing style of each note (see the *Sound On Sound article"Strings Attached" , below). Therefore, in addition to trying the methods described below, it is always worth doing some careful listening to the instrument first before recording. If you put a finger in your ear and walk around the instrument listening with the other ear, you will find that the sound changes dramatically dramatically with position because the radiation pattern is so uneven. Some engineers do this and simply find a place that*

sounds as they want it to sound, and will place the microphone there.

Method 1 - Distant Miking

A single cardioid condenser microphone slightly above and about 6 feet in front of the violin, but aimed at the F holes.

Expected Sound: A full-bodied sound with some room ambience and minimal bow noise or 'scratching'. Good for a 'classical' sound.

Method 2 - Close Miking

A single cardioid condenser microphone 2 feet or more above the violin aimed at the F holes and at right angles to the soundboard.

Expected Sound: Scratchier, nasal sound, with more bow noise. Good for fast 'fiddle' playing, or bluegrass styles, etc.

Method 3 - Live Recording

A clip on condenser microphone or pick-ups, the former usually mounted so that the capsule is pointed towards an F hole, the latter usually mounted on or under the bridge.

Expected Sound: Very dry, up-front sound, good for pop/folk violin, not so good for more classical styles.

Other factors/Issues:

- Bow noise/scratching
- Violinists tend to move (their violin) considerably when playing

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VOCALS -

NOTE: Just like recording drum kits, the subject of recording vocals could run to many hundreds of pages. All instrumental recording techniques bring with them a number of considerations that need careful thought, but the very nature of a lead vocal - after all, they it is usually the focal point of a whole song or recording - demands that recording techniques for vocals are scrutinised much more.

Problem Reflections/Room Ambience: The way that a sound reflects off different surfaces can significantly change the quality of that sound when it arrives at the microphone, and not always for the better (the pysics behind this is quite complex, but put very basically, elements of the sound might be filtered out). Large flat surfaces close to a sound source can be a particular problem. Because the lead vocal is usually the focus of a whole mix and the most 'up front' track, any such negative effects caused by these reflections are particularly noticeable and undesirable, but can be avoided by the taking the following steps:

- Positioning the singer away from flat surfaces or walls (in front or behind)
- If in a small room, lining the walls with soft furnishings (e.g. duvets or blankets)
- Keeping other reflective surfaces (e.g. music

stands) away from the direct line of sound from the singer's moith.

The ambience of therecording room or environment is always a factor to consider when recording, but particularly important when recording vocals, again because of the focal nature of a vocal track. 'Live' ambience is impossible to remove after being recorded, so the size and ambient characteristics of a room must be noted before recording.

Audio Example - Voice in a medium sized room

Audio Example - Voice in a small 'coat closet' type room

Audio Example - Voice in a large room

The Proximity Effect:

In many recording situations the proximinty effect (see the Mic Types pages) is a phenomenon that can either be used to good effect or needs to be counteracted. When close miking vocals, however, it is often a problem, particularly with cardioid condenser microphones. When a singer gets close (within a few inches) to such a microphone the proximity effect causes the low frequencies to get louder in relation to the high frequencies, resulting in a boomy, thick sound. This can be a hindrance when recording a close, intimate sounding vocal.

Eliminating The Proximity Effect: Method 1 - Microphone Bass Roll-Off Switch

Most condenser microphones are fitted with a

bass roll-off switch, which effectively 'turns down' the frequencies below a certain point (usually around 75 - 80Hz). Some microphones even allow you to choose between several different roll-off frequencies.

Eliminating The Proximity Effect: Method 2 - Mixing Desk Filter Pad

If the microphone doesn't have a bass roll-off switch (dynamic microphones don't have such things) the mixing desk might have a bass roll-off filer ot 'pad' switch, normally situated at the top of each channel. These switches are often intended for live use and have a slightly higher roll-off frequency, but they can be effective in a recording situation.

Eliminating The Proximity Effect: Method 3 - EQ

Of course, this isn't exactly a recording technique, but if the methods above are not possible, or you don't want to fix the roll-off at the recording stage, it can be instituted at the mix down stage using a low frequency shelving EQ.

Listen to the following audio examples of a vocal recording, and notice how the vocal sound changes with the adjustment of the bass roll-off:

Audio Example - 2 inches from the microphone with no bass roll-off

Audio Example - 2 inches from the microphone with 80Hz bass roll-off

Audio Example - 2 inches from the microphone with 160Hz bass roll-off

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Eliminating Plosives:

Biologically speaking, a plosive is a consonant sound produced by stopping the airflow in the vocal tract. Consonants such as p, t, k, and b fall into this category. These hard consonants can cause difficulties for the recording engineer however, as in some cases they cause a 'pop' or 'thud', such is the force with which the movement of air hits the microphone capsule.

Listen to this audio example of a problem plosive

Once recorded, this 'pop' is very difficult to remove, even with software editing techniques, so it is good practice to ensure that all problem plosives are eliminated at the recording stage. The most common method of eliminating plosives involves the use of a windscreen whcih essentially dissipates or diffuses the energy of plosive sounds. There are two main types of windscreen, a windshield and a pop shield. Dynamic microphones usually have a windscreen built in to the capsule (although it is still sometimes necessary to use an additional external windscreen), but condenser microphones don't.

Eliminating Plosives: Method 1 - Use A Foam Windshield

These often come supplied with the microphone, and are designed to fit over the top of the capsule, completely enclosing it. They are usually made from a foam material. They can muffle the

sound, attenuating the high frequencies, and are note always desirable. However, they offer the most effective means of eliminating wind noise when recording outside.

Eliminating Plosives: Method 2 - Use A Pop Shield

A pop shield usually consists of a piece of nylon stretched over a hoop. Positioned in front of the microphone, it diffuses the air enough to avoid plosives and muffles the sound less than a foam windshield.

Eliminating Plosives: Method 3 - Microphone Position

If there are no windscreens available, or windscreens on their own are not enough to eliminate some problem plosives, the microphone can be angled slightly above or below the singer's mouth (see below). Also, moving the microphone off-axis to the signer's mouth can also by allowing the air to move past the microphone capsule instead of at it.

Listen to the folowing audio examples of a vocal recordings made with and without windscreens. Notice the difference in high frequency content between the foam windshield example and the nylon pop shield example:

Audio Example - No Windscreen

Audio Example - Foam Windshield

Audio Example - Nylon Pop Shield

Microphone Type:

CONDENSER

(Large diaphragm) condenser microphones are ususally the first choice for studio vocal recording because they colour the sound less than other dynamic microphones. They also respond better to transients (the beginning or attack of a sound), another factor that helps to capture a natural sound. At a distance of 6 to 12 inches most vocal recordings made with condenser microphones sound full and warm. Close miking vocals with a condenser microphone from a distance of 1 to 3 inches produces a thick sound which is often too cumbersome and hard to mix in with other instruments.

Audio Example - A vocal melody from 6 inches with a condenser microphone

Audio Example - A vocal melody from 12 inches with a condenser microphone

DYNAMIC

Dynamic microphones are suitable for recording vocals, and some engineers and artists prefer using them. Many models exhibit a presence boost (i.e. they amplify certain frequencies) that compliments the sound of the voice. This is a coloration of the sound however, and produces a less natural sound than a condenser microphone, but can yield good results, especially if a punchier, fatter lead vocal is required. Dynamic microphones are less sensitive than condenser microphones, and to get a full natuiral sound

they need to be positioned between 2 to 6 inches from the singer.

Microphone Placement:

<u>Method 1 - Directly On-Axis</u>

A single condenser or dynamic microphone positioned directly on-axis to the singer's mouth from a distance of 6 to 12 inches (condenser microphone) or 2 to 6 inches (dynamic microphone).

Expected Sound: An even and natural tone, but susceptible to extraneous mouth noises (nose sniffs, lip smacks, breaths).

<u>Method 2 - Slightly Above Singer's Mouth</u>

A single condenser or dynamic microphone from a distance of 6 to 12 inches (condenser microphone) or 2 to 6 inches (dynamic microphone) positioned 3 to 4 inches above but aimed at the singer's mouth.

Expected Sound: This position can help to tone down a nasal sounding voice and is less susceptible to mouth noises.

<u>Method 3 - Slightly Below Singer's Mouth</u>

A single condenser or dynamic microphone from a distance of 6 to 12 inches (condenser microphone) or 2 to 6 inches (dynamic microphone) and positioned 4 to 6 inches below but aimed at the singer's mouth.

Expected Sound: This position can help to make a thin voice sound fuller, due to the extra 'low end' picked up from the chest cavity. It can also also pick up more extraneous voice noises

however.

Reading:

Recording & Production Techniques pages 33-39

Basic Microphones pages 91-106

Music Technology: A Survivor's Guide pages 41-51